RESEARCH PRODUCTIVITY IN ORGANIC CHEMISTRY USING WEB OF SCIENCE 2006-2021: A SCIENTOMETRIC STUDY

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Introduction

With sophisticated technology the remarkable progress made by science and technology which led to massive growth of information all over the world. In order to access the quality of information scientific tools and techniques is essential to analyze the inherent characteristics of information. There are a number of problems associated with information patterns and it's difficult to obtain accuracy and relevancy of information according to research. Charles Bermier stated that " today's scientific literature is so large that one person can no longer read the output in any branch of a subject". Therefore information professionals formulated various theories, laws and formulas to find out publication patterns of information, analyzing techniques, measuring utility rate and assess the quality indicators. Metric studies are an integral part of information research. Scientometrics is a field of study that deals with measuring and analyzing the science of science, communication in science, and science policymaking. Scientometrics is a subfield of bibliometrics that was created half a century ago and is concerned with quantitative analysis, comparisons of activity, productivity and scientific innovation. The term scientometrics is referred to as a quantitative tool that was applicable to measure human communication. The term naukometriya which is taken from Russia, is rendered as scientometrics in English. The term scientometrics was coined by Vassily. V. Nalimov & Mulchenko in the year of 1969. Scientometrics is defined "as the study of measuring and analyzing citation variables which is concerned with quantitative analysis tools by means of measuring, counting, analyzing, and comparing the data." The scientometrics and bibliometrics are frequently used interchangeably as terms for measuring the thrust area of research, the evolution of that research over a time and contributions of academic institutions and nations. Scientometrics encompasses the Growth of literature, Authorship pattern, core periodicals, mapping techniques, and citation impact. The scientometric analysis had a significant impact on information usage patterns as well as the quality of information. The purpose of scientometrics is to shed light on the process of written communication and the course of discipline by means of country and analyzing various facts of written communication in the field of science.

Organic Chemistry

The human civilization or human life would have not been, what it is today without the development of organic chemistry because of proteins, Carbohydrates, and fats from the bulk of our food materials. The term organic chemistry first appeared in the year 1801 by Novalis in his writings determined the formulae of numerous organic compounds with their improved methods of analysis by combustion with copper oxide. Chevreul (1786-1889) who was the founder of organic chemistry made an analysis of the organic compounds and composition of oils, fats and vegetable colors. The organic compounds dealt as a separate branch as a matter of convenience because all these compounds were carbon-containing compounds. Hence organic chemistry became compounds like carbonic acid, carbonates, bicarbonates and carbon oxides. The other definition is organic chemistry is the chemistry of hydrocarbons and their derivatives and is obtained from natural sources by synthetic processes.

Review of Literature

Gunaseelan S and Ranganathan C (2023) examine the application of bibliometric laws in global limnology research publications: A scientometric analysis based on a web of science during 1989-2020. Their study analyzed publication growth, core periodicals and doubling time. The citation data were analyzed using Bradford's law, Lotka's law, Zif's law and Price theory. The word Limnology was used to retrieve 1499 publications and Histcite and VOS viewer software were used for tabulation and mapping. The study revealed that the top 25 journals produced 43.9% of publications and the journal Hydrobiologia has produced a maximum number of articles. The author's productivity does not follow Lotkas law and keyword distribution is less compared to the title-wise search. The study proved only the 80/20 principle in the field of Limnology.

Kesavan et.al (2023) investigated the growth of soft computing literature around the world. Their study analyzed the outstanding performance of the soft computing domain and subdomain of neural networks, machine learning, and genetic algorithms. The study also analyzed the impact of citations produced by institutions as well as authors published from 2009 to 2019. The study found that China has made more publications and productivity of authors compared to Russia, and Saudi Arabia and in turn, a key had minimum productivity of authors.

Kumari and Kumar (2023) investigated the collaborative authorship pattern in the computer science discipline. Their study analyzed the productivity of authors, authorship patterns, and collaborative measures in the sub-fields of computer science. The researcher categorized the fields and subfields of computer science like Artificial intelligence, machine learning, and programming language was identified the core journal as a source of the study. The study was conducted for an eleven-year period from 2010 to 2020. The result found that the multi - of authors' papers increased compared to single-author papers while three-author papers had been highly published in journals at the same time the four-author articles decreased. The highest growth rate was found in the conference proceedings. The maximum number of co–authors have produced articles in the conference proceedings and journals.

Verma. R and Shivakumar (2023) assessed the quality of the doctoral thesis at Punjab University in Chandigarh. Their study analyzed the important insights of research perception. The study adopted a survey method and 48 respondents were surveyed using a questionnaire method. The respondents were asked about the reason for pursuing a Ph.D., the quality of research, and job opportunities after completing a Ph.D. The finding revealed that more than two-thirds of researchers say the quality of research done at Punjab University and one-seventh of respondents say theoretical or Bookish. Also 30% of respondents found their research work path-breaking another 60% of respondents applied, one-fifth of respondents say the physical infrastructure of research has improved in the department, and one-third of respondents say the good quality of research available in the department's western models dominated research and national, regional models should be addressed and prioritized.

Bapte, V., & Nagpal, R. (2023). Did a bibliometric study covering all plagiarism-related issues related to scientific communication. Their study focused quantum of research work from 1989 to 2022 and also analyzed country-wise output, the number of literature published around the world, citations, and co-occurrences of maps. Bradford’s law was applied to found core periodical and highly cited authors as well as average citation per publication during the study period. The result found that the Drummod has a highly cited author who has received 2040 citations. The annual percentage of growth rate was 3.67 and the UK, and the USA highly contributed to China and Iran had the least contribution and the Journal of Physiology was the highly cited article.

Janen .T (2022) studied the research output of the University of Jaffna Srilanka during 2000 – 2019. A scientometric tool was applied to analyze the publication trend, funding agencies, institution, author and journal. The sample of the study consisted list of indexed journals by Web of Science. The result found that 1328 research publications during the study period. The single-author article was only 17. The faculty of science dominating which top 10 authors with 44 publications. The physics department leads high citations with 22 publications. The highest number of growth was found in the year of 2019 and the least number of publications in the year 2005.

Kumari, Jachak & Gupta (2022) did a scientometric study to assess the research output of Ravishankar Shukla University of Chandigarh. Their study assessed the qualitative research to measure the impact of citation and also measure the institution's impact. A total of 1710 research papers have been published during 1989 – 2020. The study found that the year–wise productivity of articles has increased and found a single authorship trend. 97.19% of articles were produced by single authors and the remaining were two or more authors. The faculty of science like physics and chemistry has produced the maximum number of articles and the year 2020 was the maximum growth rate and the research articles were the major form of publication

Statement of the Problem

The researcher intends to know about the growth of publication output in the field of organic chemistry and examine the impact of contents published in terms of disciplines and sub-disciplines dealt with organic chemistry during 2006-2021. Hence the researcher chooses a research problem that should be entitled **"RESEARCH PRODUCTIVITY IN ORGANIC CHEMISTRY USING WEB OF SCIENCE 2006 -2021: A SCIENTOMETRIC STUDY"**

Significance of the study

In the era of knowledge-based civilizations, information sources are essential commodities for research development, modernization and a booming economy. Every act of human life has been influenced by the process of information and the progress of scientific activity. Since science publication and dissemination are still insignificant. The proliferation of information, source of information, origin, accessible pattern, consistency, credibility and quality make barriers to access information and dissemination. Hence the study empathizes the following research question

- What is productivity and how is it measured?
- What are the forms of output to be measured?
- How to assess the quality of information?
- Where to find the origin of information and its conditionals?
- Which type of statistical tools and techniques are available to measure scientific productivity?
- What percentage of papers is published in each country or institution?
- Which country or region has the potential of organic research?

Therefore the study is conducted to find suitable solutions to research problems in the area of organic chemistry.

Objectives of the study

- To analyze the research output of organic chemistry during 2006 – 2021 using the Web of Science
- To determine the growth of research productivity on organic chemistry literature
- To identify the form–wise distribution and journal–wise distribution of publications with citations and cited references
- To examine the distribution of publication productivity across leading subject areas.
- To assess the global research productivity of publication by individual authors, institutions and country
- To determine the authorship pattern and nature of collaboration and co-authorship pattern
- To identify the language–wise distribution of publications on organic chemistry
- To know the most preferred journal to publish articles by scientists and scholars
- To analyze the distribution of research output by academic institutions, government-funded and R&D institutions
- To examine the most prolific institutions and authors in the field of organic chemistry
- To identify the highly cited articles and H – index, and G – Index of global countries
- To analyze the research productivity of organic chemistry using empirical laws of bibliometrics
- To visualize the mapping of organic chemistry by VOS viewer.
- To find out the productivity rate of patents in organic chemistry during 2006 -2021

The Hypothesis of the Study

H0: There is no association between the growth of literature and year–wise productivity.

H0: There is no association between the type of document on organic chemistry and the research output of other publications.

H0: There is no association between the increasing trend of research productivity and collaborative research during a study period.

H0: There is no association between single-author papers and multi-author papers

H0: There is no association between highly cited publications and the productivity of authors

H0: There is no association between degrees of collaboration dominance in the field of organic chemistry

H0: There is no association between the productivity of literature and the h-index position of institutions

H0: There is no association between preference of language to access and publish of articles in the field and sub-field of organic chemistry.

H0: There is no association between empirical laws of bibliometrics and research productivity in organic chemistry.

Methodology

The methodology of science is a set of tools and techniques to study the methods, which is a theory to select research methods and procedures to apply the techniques in scientific research. Furthermore, the methodology explains how to achieve research goals and guidelines the method is applied within a theoretically justified procedure. It is a key role of research to frame the objectives and hypothesis, pertinent statistical tools and techniques to collect and analyze the data in a systematic way to confine the research. The present study aims to find a solution to solve a research problem in a scientific way. The study adopted scientometric and bibliometric techniques to analyze the research productivity of organic chemistry. For the analysis, the researcher used a Web of Science citation database covering the period of 2006 - 2021.

Data collection

The bibliographic citations obtained from the Web of Science database were published from 2006 to 2021. Whereas there were 40926 articles were published till 31st December 2021. A basic search was conducted to find cumulative literature in the field of organic chemistry and an advanced search was conducted to find subfields of organic chemistry. The major fields were identified as organic chemistry or organic compounds and organic molecules. On the basis of major and subfields of keywords are added in the advanced search. The search strategy was conducted AND and OR terms to find a relevant related to organic and the NOT operator was used to eliminate the irrelevant items contained in the results and also used to pre-processing of data in the field of chemistry from Web of Science core collection. The filter was applied to cover the time span of the study from 2006 to 2021. The researcher conducted a search term of publication titles and extraction of data was exported using plain text and tab-delimited format of 500 records per time were downloaded from the Web of Science core collection.

Statistical tools and techniques

The formulas, empirical laws, and statistical software packages are used to collect and measure research variables. The collected data were analyzed to following tools:

Bibliometric laws

Prolific institutions

Prolific authors

Linear growth

Doubling time

Degree of Collaboration

Relative Growth Rate (RGR)

Cumulative Growth Rate (CGR)

Activity Index

H – Index

Chapter organization of the study

The entire study has been organized under five chapters as follows:

Chapter – I: Introduction

The first chapter deals with the elements of metrics, definitions, and various types of metrics such as bibliometrics, scientometrics, altmetrics, and scientometric applications in different contexts to measure the quantitative qualitative aspects of scientific literature and the study area of the research. The brief introduction about chemistry and organic chemistry.

Chapter – II: Review of Literature

The second chapter deals with a review of literature related to the research problem and the researcher has collected plenty of reviews from national and international databases and journals. The collected reviews were arranged in chronological sequences.

Chapter – III: Research Methodology

The third chapter presents the overview research design of the study such as the theoretical part of the study, statement of the problem, the significance of the study, objectives and hypothesis, statistical tools and techniques, scope and limitation, and chapter organization of the study.

Chapter – IV: Data analysis and Interpretation

The fourth chapter presents the results of the study in tabular columns and figures along with interpretation.

Chapter – V: Findings and Conclusion

The fifth chapter presents the major findings of the study, remarks, and suggestions concluding with future research.

References

1. Hood, W,W. & Wilson C.S. (2001). The literature of Bibliometrics, Scientometrics, and Informatics. Scientometrics. 52(2), 291 -314.
2. Streitwieser, A., Heathcock, C. H., Kosower, E. M., & Corfield, P. J. (1992). *Introduction to organic chemistry* (No. 547 STR). New York: Macmillan.
3. Mamdapur, G. M. N., Rajgoli, I., & Mamdapur, A. K. (2013). Scientometric analysis of contributions to the journal college and research libraries (1997-2011). *Mamdapur, Ghouse Modin N. Mr*, 1997-2011.
4. Gunaseelan, S., Ranganathan.C .,(2023). Application of Bibliometric Laws In Global Limnology Research Publications: A Scientometric Analysis Based On Web Of Science 1989-2020. *Kelpro Bulletin*
5. Kesavan, M. B., Ramkumar, S., Kartheeswaran, S., Lavakumar, V., Elanjiyam, G., Priya, B. S., & Thamaraiselvi, G. (2023). A scientometric study on components of Soft Computing methods from 1999 to 2019 for top most populated countries from Asian Continent. *Applied Nanoscience*, 1-26.
6. Kumari, Priti, and Rajeev Kumar.(2023).Collaborative authorship patterns in computer science publications." *Annals of Library and Information Studies (ALIS)* 70(1), 22-32.
7. Vishal Datterey.B,., Ritu Nagpal., (2023).Contemplating and Visualizing Plagiarism Through a Bibliometric Study. *DESIDOC Journal of Library & Information Technology*, *43*(2), 112- 118.
   DOI : 10.14429/djlit.43.2.18419
8. Verma.R,., Shivakumar. (2023). Mapping of Doctoral Research Output in Library and Information Science at Panjab University at Chandigarh. *DESIDOC Journal of Library & Information Technology*, *43*(2). 94 – 100.
9. Bapte, V., & Nagpal, R. (2023). Contemplating and visualizing plagiarism through a bibliometric study. *DESIDOC Journal of Library and Information Technology, 43*(2), 112-118.
10. Janen, T. (2021). Research Output of University of Jaffna, Sri Lanka during 2000-2019.